CHAPTER 2

LITERATURE REVIEW

2.1 Routing Process

Routers are amongst the most crucial components of the internet, as each bit of information on the internet passes through many routers [2]. Routin*g* is the act of moving information across an inter-network from a source to a destination.

Router sends packets back and forth between multiple network segments, such as between Ethernet, ADSL, and LocalTalk networks which all coming in to the same machine, but possibly on different ports or cards [3]. Once out of the LAN, packets are steered to destination by Internet routers. Each router has an Internet address.

Router has "router table" listing final destination and next hop, for each packet matches final destination, then sends packet on its next hop to the next router. There are usually many possible routes to destination, so routers have a method of making the choice, usually based on low traffic and therefore probably fastest time.

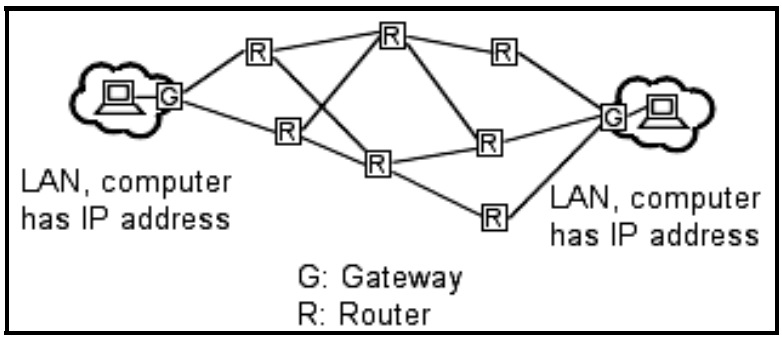

Figure 2.1 Routers and Gateway [4]

Referred to **Figure 2.1**, it shows the connections between two computers by gateway and routers. A gateway is widget that translates data from one protocol (like TCP/IP) to another protocol (like AppleTalk) as it flies past. The widget may also choose to not translate some packets, and filter them out [5]. The most important characteristic of a gateway is protocol translation.

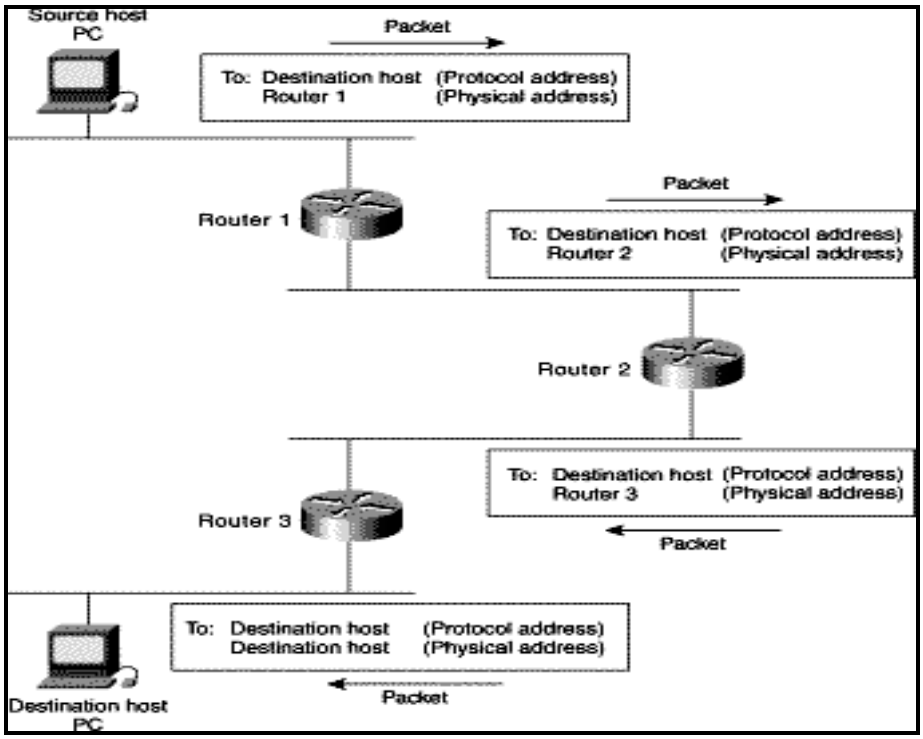

Figure 2.2 Example of Numerous Routers [6]

Referred to **Figure 2.2,** we should have known that routing involves two basic activities:

- Determining optimal routing paths
- Transporting information groups (typically called packets) through an Inter-network.

In the context of the routing process, the latter of these is referred to as packet switching. Although packet switching is relatively straightforward, path determination can be very complex. However, the Linux router is easy to handle and configure. It does not require any special care for its use other than that required for a normal PC. If there is any problem, configuring it only takes a few minutes [7].

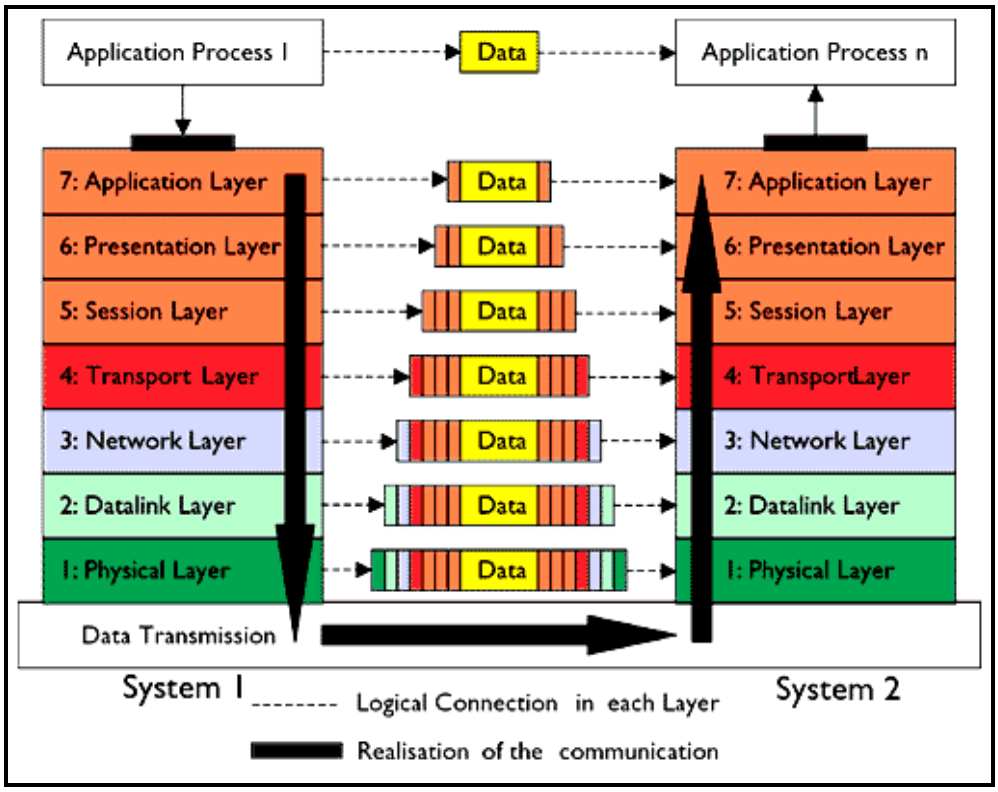

Figure 2.3 OSI Reference Model [8]

The OSI model above is the basic model describing the data movement through a network. The Open Systems Interconnection (OSI) reference model describes how information from a software application in one computer moves through a network medium to a software application in another computer. The model is a conceptual model composed of seven layers, each specifying particular network functions. It divides the tasks involved with moving information between networked computers into seven smaller, more manageable task groups, then assigned to each of the seven OSI layers.[9]

We can refer to **Figure 2.3**; the primary difference between the two is that bridging occurs at Layer 2 (the link layer) of the OSI reference model, whereas routing occurs at Layer 3 (the network layer). This distinction provides routing and bridging with different information to use in the process of moving information from source to destination, so the two functions accomplish their tasks in different ways.

When we send any data across the network, it flows in the form of packet, besides containing data itself these packets contains two addresses. One which is assigned to the machine sending data i.e. source address and other assigned to the machine receiving data i.e. destination address [10]. The addresses, which we are talking about, are known as IP addresses. IP stands for internet protocol. All computers across the internet are assigned a globally unique identifier called IP address. IP addresses are used as street addresses so other computers can locate them, these addresses takes the form of four numbers separated by dots e.g. 124.45.69.89.

2.2 TCP / IP

TCP/IP is the suite of protocols used by the Internet and most LANs throughout the world. In TCP/IP, every host (computer or other communications device) that is connected to the network has a unique IP address. An IP address is composed of four octets (numbers in the range of 0 to 255) separated by decimal points. The IP address is used to uniquely identify a host or computer on the LAN [11]. For example, a computer with the hostname Hostlinux could have an IP address of 192.168.7.127. We should avoid giving two or more computers the same IP address by using the range of IP addresses that are reserved for private, local area networks; this range of IP addresses usually begins with the octets 192.168.

2.2.1 Static Vs Dynamic IP addresses

An IP address identifies a computer or other device to a network. The basic concept is simple: every device on a network needs to have its own address. In that way, data is sent to the right place. There are IP addresses are used by the whole Internet, and others, only used by locally, for example in our home. The IP address from your ISP is assigned one of two ways:

- Set to an IP address which is unchanged for months or years at a time. This is a *static IP address* [12].
- Set to an IP which is only good for a limited time, and which is changed according to the policy set by your ISP's DHCP server. This is a *dynamic IP address* [13].

Because a static IP can be relied on for an indefinite period, some networking software requires a static IP. ISPs usually charge extra for static IPs. Your ISP may not be willing to give their customers static IP addresses at all. Dynamic IPs are used in large networks where computers are frequently reconfigured, or where a limited number of IP address are available to share between many computers.

2.3 Local Area Network (LAN)

2.3.1 LAN network address

The first three octets of an IP address should be the same for all computers in the LAN. For example, if a total of 128 hosts exist in a single LAN, the IP addresses could be assigned starting with 192.168.1.*x*, where *x* represents a number in the range of 1 to 128. We could create consecutive LANs within the same company in a similar manner consisting of up to another 128 computers. Of course, we are not limited to 128 computers because there are other ranges of IP addresses that allow us to build even larger networks.

There are different classes of networks that determine the size and total possible unique IP addresses of any given LAN. For example, a class A LAN can have over 16 million unique IP addresses. A class B LAN can have over 65,000 unique IP addresses [14].

Address range	**Subnet mask**	**Provides**	**Addresses per LAN**
10.0.0.0 - 10.255.255.255	255.0.0.0	1 class A LAN	16,777,216
172.16.0.0 - 172.31.255.255	255.255.0.0	16 class B LANs	65,536
192.168.0.0 - 192.168.255.255	25.255.255.0	256 class C LANs	256

Table 2.1 Address ranges and LAN sizes [15]

According to **Table 2.1**, it shows that the size of our LAN depends on which reserved address range we use and the subnet mask associated with that range.

2.3.2 Network and broadcast addresses

Another important aspect of building a LAN is that the addresses at the two extreme ends of the address range are reserved for use as the LAN's network address and broadcast address [16]. The *network address* is used by an application to represent the overall network. The *broadcast address* is used by an application to send the same message to all other hosts in the network simultaneously.

For example, if we use addresses in the range of 192.168.1.0 to 192.168.1.128, the first address (192.168.1.0) is reserved as the network address, and the last address (192.168.1.128) is reserved as the broadcast address [17]. Therefore, we only assign individual computers on the LAN IP addresses in the range of 192.168.1.1 to 192.168.1.127:

Network address:	192.168.1.0
Individual hosts:	192.168.1.1 to 192.168.1.127
Broadcast address:	192.168.1.128

Table 2.2 LAN IP addresses

2.3.3 Subnet masks

Each host in a LAN has a subnet mask. The *subnet mask* is an octet that uses the number 255 to represent the network address portion of the IP address and a zero to identify the host portion of the address [18]. For example, the subnet mask 255.255.255.0 is used by each host to determine which LAN or class it belongs to. The zero at the end of the subnet mask represents a unique host within that network.

2.3.4 Domain name

The *domain name*, or *network name*, is a unique name followed by a standard Internet suffixes such as .com, .org, .mil, .net, etc. We can pretty much name our LAN anything if it has a simple dial-up connection and our LAN is not a server providing some type of service to other hosts directly [19]. In addition, our sample network is considered private since it uses IP addresses in the range of 192.168.1.x. Most importantly, the domain name of choice should not be accessible from the Internet if the above constraints are strictly enforced. Then, to obtain an "official" domain name we could register through InterNIC, Network Solutions or Register.com.

2.3.5 Hostnames

Another important step in setting up a LAN is assigning a unique hostname to each computer in the LAN. A hostname is simply a unique name that can be made up and is used to identify a unique computer in the LAN [20]. In addition, the name should not contain any blank spaces or punctuation. For example, the following are valid hostnames that could be assigned to each computer in a LAN consisting of 5 hosts: hostname 1 - Try; hostname 2 - Truck; hostname 3 - Tank; hostname 4 - Time; and hostname 5 - Tide. Each of these hostnames conforms to the requirement that no blank spaces or punctuation marks are present. Use short hostnames to eliminate excessive typing, and choose a name that is easy to remember.

Table 2.3 summarizes what we have covered. Every host in the LAN will have the same network address, broadcast address, subnet mask, and domain name because those addresses identify the network in its entirety. Each computer in the LAN will have a hostname and IP address that uniquely identifies that particular host. The network address is 192.168.1.0, and the broadcast address is 192.168.1.128. Therefore, each host in the LAN must have an IP address between 192.168.1.1 to 192.168.127.

IP address	Example	Same/unique
Network address	192.168.1.0	Same for all hosts
Domain name	www.yourcompanyname.com	Same for all hosts
Broadcast address	192.168.1.128	Same for all hosts
Subnet mask	255.255.255.0	Same for all hosts
Hostname	Any valid name	Unique to each host
Host addresses	192.168.1.*x*	*x* must be unique to each host

Table 2.3 Sample IP addresses for a LAN with 127 or fewer interconnected computers